



COURSE: Sanitary-Environmental Engineering			
ACADEMIC YEAR: 2019/2020			
TYPE OF EDUCATIONAL ACTIVITY: Characterizing			
TEACHER: IGNAZIO M. MANCINI, DONATELLA CANIANI			
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Language: Italian			
ECTS: 8 for theoretical lessons, and 1 for classroom tutorials	n. of hours: 75 hours for theoretical lessons, and 15 hours for classroom tutorials	Campus: Potenza School of Engineering Program: Bachelor Degree in Civil and Environmental Engineering	Semester: I and II

EDUCATIONAL GOALS AND EXPECTED LEARNING OUTCOMES

The course deals the basic concepts of Sanitary-Environmental Engineering (ICAR/03), giving attention to the main criteria for a suitable wastewater/waste management and treatment.

Learning outcomes

The main aim is to evaluate the potential environmental impacts of the water pollution, providing methodologies for a sustainable water cycle.

The main items will be:

- Basic concepts of the principal biochemical kinetics;
- Mass balances of substrate and biomass in real and ideal reactors;
- Description of the main treatment units for wastewater/water treatment;

Learning results

The main skills will be:

- to analyze the water pollution phenomena and describe the basic kinetic reactions;
- to analyze the ideal reactors behavior by means of the mass balance equations;
- to identify the biological, chemical, and physical processes occurring in the wastewater treatment units;
- to evaluate the main issues occurring in the wastewater treatment and management.

Communicative Skills

The student will be able to communicate with competence and language skills on the potential environmental impacts of the water pollution, providing methodologies for a sustainable water cycle and the main issues occurring in the wastewater treatment and management.

Learning Skills

The student will be able to analyze the water pollution phenomena and describe the basic kinetic reactions, analyze the ideal reactors behavior by means of the mass balance equations, identify the biological, chemical, and physical processes occurring in the wastewater treatment units and evaluate the main issues occurring in the wastewater treatment and management.

PRE-REQUIREMENTS

In order to attend this course, the basic concepts of the courses "Chemistry", "Physics", and "Mathematic I" have to be well known (e.g. stoichiometry of chemical compounds; redox reactions; liquid properties: solubility, concentration, molarity, molality, Henry's Law; chemical equilibrium; pH; vectors; kinematics; differential equations; integrals; etc.).

SYLLABUS

Stoichiometric and kinetic aspects of reactions: reversible and irreversible reactions, homogeneous and heterogeneous reactions, order of reactions. Ideal and real reactors: batch reactor, continuous flow stirred tank reactor (CFSTR), plug flow reactor (PFR), mass balances of biomass and substrate, analysis of the response of



reactors to impulse signals and step signals, comparison between CFSTR and PFR reactors, series of reactors.
Wastewater/water characterization: chemical, physical, and biological parameters. Description of the water pollution phenomena.
Methodologies for wastewater treatment: primary, secondary, and tertiary treatments; chemical, physical, and biological processes.
Theory of gravity separation: theory of settling of isolated particles; theory of solid flux; basic concepts for settler design.
Biological reactors: biological kinetics; oxidation tanks and membrane technologies (MBR); nitrification and denitrification; basic concepts for biological compartment design. GreenHouse Gas emissions from wastewater treatment.
Mass transfer: liquid/gas mass transfer phenomena; absorption and gas-liquid desorption; kinetic of the process; ion exchange, membrane processes.
Filtration: volumetric and surface filtration, gaseous and liquid fluxes through porous media.
Disinfection: chlorination, ozonization.
Sludge treatment and disposal: settling, thickening, dewatering.

TEACHING METHODS

The course provides 90 hours for theoretical lessons and exercises. Particularly, 75 hours will be theoretical lessons and 15 hours will be classroom tutorials. A technical visit at the wastewater treatment plant located in Potenza is provided, as well the technical visit at the water treatment plant. Seminars by external experts are provided, focusing on the biological nitrogen removal processes and GreenHouse Gas emissions from wastewater treatment.

EVALUATION METHODS

Oral examination. The exam focuses on the arguments investigated during the theoretical and tutorial lessons. To pass the oral exam the student must acquire at least 18 points out of 30.

TEXTBOOKS AND ON-LINE EDUCATIONAL MATERIAL

- Metcalf & Eddy. Wastewater Engineering Treatment and Reuse. McGraw-Hill.
 - PIERO SIRINI, INGEGNERIA SANITARIA-AMBIENTALE, MCGRAW-HILL, 2002.
 - Professor handbook.
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INTERACTION WITH STUDENTS

- Firstly, the course aims, syllabus, and evaluation methods will be defined. Secondly, the professor's handbook will be provided by means of dropbox folders. Simultaneously, a student list will be done, including first name, last name, student ID, e-mail.
 - Professor's office hours: Wednesday from 10.30 a.m. to 12.30 p.m. If there is the need to more explanations about the items argued during the course, further office hours could be defined subsequently, by contacting the professors by email or by phone.
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EXAMINATION SESSIONS (FORECAST)¹

24/09/2019, 17/10/2019, 14/11/2019, 12/12/2019, 16/01/2020, 13/02/2020, 12/03/2020, 16/04/2020, 14/05/2020, 18/06/2020, 23/07/2020.

SEMINARS BY EXTERNAL EXPERTS YES NO

FURTHER INFORMATION

¹ Subject to possible changes: check the web site of the Teacher or the Department/School for updates.